EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PREPAREDNESS
WASHINGTON, D.C. 20504

August 3, 1970

MEMORANDUM FOR CHAIRMAN, ARGO STEERING COMMITTEE,
OFFICE OF SCIENCE AND TECHNOLOGY,
EXECUTIVE OFFICE OF THE PRESIDENT

FROM: Chairman, National Disaster Support Task Group

SUBJECT: Task Group Report

Pursuant to the instructions from the Director, Office of Science and Technology given to this Task Group in the initiating correspondence of February 9, 1970, the final report is herewith submitted.

The Task Group has met at the U. S. Geological Survey Special Projects Office at Reston, Virginia, on a regular basis since February 17, 1970. During this period, it has considered the requirements for immediate disaster information as can be provided by available reconnaissance systems: types and specifications of these systems as appropriate to meeting these needs; sources of photographic interpretation personnel within the Federal agency community; administration and communications channels to be utilized for initiating disaster support tasks and for information dissemination.

Having considered each of these requirements and resources in detail, the Task Group has recommended procedures which, upon implementation, are expected to achieve an effective convergence of these resources to meet the critical data needs as specified.

The conclusions and recommendations contained in this report represent the considered views and best judgment of the Task Group members. It is the hope of the Task Group that, after consideration by the ARGO Steering Committee, the recommendations will be accepted and implemented at the earliest occasion.

Respectfully submitted,

[redacted] STAT

Attachment - Task Group Report

Cy 11

APPLICATIONS OF REMOTE SENSING IMAGERY

IN

NATURAL DISASTER EFFECTS ASSESSMENTS

Report Prepared by:

NATIONAL DISASTER SUPPORT TASK GROUP, AUGUST 1970

Sanitized Copy Approved for Release 2010/03/23 : CIA-RDP80T01137A000300010001-6

PREFACE

Shortly after Hurricane Camille struck the coastal areas of Mississippi, Louisiana, and Alabama on August 16 and 17, 1969, efforts were made by the Office of Emergency Preparedness (OEP), the Office of Science and Technology (OST), the Corps of Engineers, and other elements of the Federal Government to acquire as rapidly as possible full aerial photographic coverage of the disaster areas. There was, however, no overall coordinative planning for the acquisition of this coverage.

Aerial photography of those coastal areas was subsequently flown by the U. S. Air Force, ESSA, NASA, U. S. Department of Agriculture, and the Corps of Engineers (under private contract). The coverage flown by the U. S. Air Force was accomplished in response to the interest expressed by OEP, OST, and the Corps of Engineers; the other imagery was obtained in specific response to those agencies' separate requirements.

The Corps of Engineers produced photographic mosaics for immediate field use in the direction and planning of debris clearance, repair and related operations. Color photography flown by ESSA was utilized in the examination of changes and adjustments in the coastal areas affected by the heavy tidal action. Processing difficulties and priorities prevented the timely use of the NASA photography.

The photography flown by the Air Force was utilized by the Office of Emergency Preparedness in the preparation of a crash, pilot photographic interpretation study (Exhibit I). This study was undertaken to demonstrate that critically needed information on overall area effects, accessible transportation routes, extent of housing damage and destruction, industrial damage, conditions of maritime installations, and so forth, could be made rapidly available to Federal and State agency heads and field teams. The study was conducted with the support of several of the agencies subsequently represented on the Task Group and was accomplished at the U.S. Geological Survey Special Projects Office (SPO) at Reston, Virginia. Results of the study were brought to the attention of the Director of OEP via internal channels, the Director of OST through the ARGO Steering Committee, and to other agencies via their ARGO representatives.

The interest generated was followed by an exchange of correspondence between the Directors of OEP and OST, and resulted in the establishment of this Task Group.

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SUMMARY

This report reaffirms the requirements for domestic disaster effects information and its timely need by national and local authorities for disaster relief and management purposes and defines those critical information needs which may be met from aerial photographic sources.

The report identifies aerial photographic data acquisition, data reduction, and analytical resources available to the Federal Government for tasking.

Mechanisms are described for assuring that these resources could be effectively utilized and managed for rapid damage effects assessment under an interagency effort to be initiated and coordinated by the Office of Emergency Preparedness.

Recommendations are made for early approval and implementation.

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INTRODUCTION

Pursuant to the instructions in a letter of February 9, 1970, from Director, OST, the Task Group met initially on February 17, 1970, at USGS Reston and regularly thereafter. Early in the discussions of the group, there was recognition that the problem the Task Group had to address was to match the determinable characteristics of major disaster situations and their consequent information needs with those types of aerial photographic data acquisition and reduction resources which would be available. The comments made by individual Task Group members reflected their belief that resources under discussion were available and what was needed was the mechanism to pull these existing resources together when required by priority needs. No research and development effort is proposed or contemplated.

Tasks were developed to define information needs and to identify what resources were available to meet them. These tasks are listed below and are discussed in detail in Annexes A through E of this report:

1. Platform Resources
2. Tasking Channels
3. Photographic Interpretation Resources
4. Command Nets
5. Types of Disasters and Information Needs

Finally, it should be observed that in the not-too-distant future, remote sensing data from earth resources satellite systems may become available. It is not implied that these data will automatically reduce the value and utility of aircraft-derived imagery. Utilization of remote sensing imagery from these earth resources satellite systems should however provide additional opportunities for the development of coordinated skills, procedures, techniques, etc. for natural disaster assessment applications as well as other purposes among user agencies.

DISCUSSION

Natural disasters such as floods, hurricanes, tornadoes, earthquakes, tidal waves, forest fires, and serious disasters of man-made origin have been of major concern to the Federal, State, and local governments since the founding of this nation. In recent years, the growth of population centers, with their increasing dependence upon communications, transportation, electric power, life support (housing, subsistence, medicines), etc. have greatly increased the complexity and costs of disaster recovery, and has caused the Federal Government to assume a broader role in disaster recovery.

Since 1953, 243 incidents (involving floods, tornadoes, and hurricanes in various combinations) costing the Federal Government approximately $345.6 million have been declared national disasters. An additional 50 or so declarations involved earthquakes, fires, draughts, etc. during this same time period. The systematic use of aerial photography in many of these situations at both the national and local levels could probably have greatly increased the effectiveness of the aid rendered, and conceivably reduced the cost of this aid by permitting timely decisions to be made on what, where, and how much aid was needed. For example, timely aerial photographic coverage of the Camille disaster area would have provided information useful in planning for: highway clearance and rehabilitation; housing losses; debris clearance contracts; location of trailer and emergency shelter sites; priorities for restoration of public utilities; school repair and restoration; diversion of traffic and alternate routes for highway, rail, and shipping; damage to food processing and storage facilities; and required timber clearance to minimize damage to adjacent forest lands.

In addition to the post-disaster types of application noted above, the use of aerial photography to monitor conditions with high potential for disaster is also required. The monitoring of snow packs and the melt rates can give advance warning of floods and potential size of flood areas. It can also supply the information needed to operate flood control installations, such as dams and reservoirs, to minimize or prevent flooding in some cases. Additionally, this information is also needed to prevent the wastage of water by draining reservoirs in anticipation of snow melt and runoff which may not exist.

As a case in point, during the meetings of the Task Group late in March 1970 ESSA requested assistance in obtaining photographic coverage of snow pack accumulation in west-central parts of the country. OEP arranged for the U. S. Air Force to fly the photographic missions, information from which would be used in conjunction with information from ESSA's operational satellites and from ground survey teams. In spite of acquisition delays because of weather, this very high quality photography was very useful to ESSA. Specifically, the photography established that the snow cover was gone in relatively flat areas--confirming prior data. However, substantial amounts of snow remained in canyons, ravines, and ditches where regular observations are not available contributing to unexpected run-off from areas believed snow-free. Additional uses to which this photography will be put include training ESSA personnel in snow-pack evaluation techniques and inclusion in a pre-disaster data base at USGS SPO, Reston.

In another more recent instance, immediately after the devastating tornado struck Lubbock, Texas on May 11, 1970, OEP requested NASA to consider the prospects of a quick-response mission over the devastated area by one of the Houston-based Earth Resources Program aircraft. NASA responded by having the P3A (See Platform Resources, Annex A, Incl. 1) over the city by 12:30 P.M. on May 12 and shipping the resultant processed imagery to Washington, D. C. the following day. Damage effects assessment were undertaken by a team represented by elements of this Task Group, and the results of the photographic analysis were made available to the Director, OEP, and his staff early Thursday morning, May 14. Subsequent utilization of data and requests for selected copies of the photography were received from ESSA, Corps of Engineers, USDA, USGS, National Bureau of Standards, and OEP (headquarters and field). Copy of the briefing board prepared for the Director, OEP, is shown as Exhibit VII.

All disasters are not solely of natural origin. The effects of large-scale industrial accidents, such as explosions, fires, and oil well leaks and spillage, have been exceedingly costly of life and property. The survey and examination of oil-contaminated coastal areas by aerial photography is already a fairly routine practice.

The types of disaster and the extent of the disaster area will vary from one incident to another and so therefore will the requirements for aerial photography. An examination of these varying and timely information needs has been made and is described in Annex E.

Fortunately, the capability presently exists in inventories of collection platforms and cameras within various agencies of the Federal Government (DOD, NASA, ESSA, USGS, USDA, etc.) to meet these information needs. Some collection capability also exists at the State level and with the National Guard. This is also true for the photo interpretation, data reduction, and photo processing equipment requirements. The State resources in these areas, however, are limited, especially with respect to data reduction and photo processing. Most State highway and geological organizations have some photo interpretation personnel but are very limited in equipment resources.

The diversity of aerial photographic capability and agencies controlling these capabilities has represented both strengths and weaknesses in the use of these tools in the past. There has not been, however, a mechanism in being to provide for the coordinated and systematic use of these resources to insure the most effective utilization of collection platform, camera, and photo interpreter combinations. In order to assure the required coordination and tasking of the resources, a central point of contact is required. It is proposed in this report that OEP provide this function by establishing a small, permanent Secretariat (rapidly expandable from Task Group membership) to provide support to its disaster management organization to provide the following functions:

1. Coordinate requirements for aerial photography and initiate requests for coverage through the appropriate channels.

2. Coordinate the extent of need for photo interpreters and other technical support, and initiate requests for such support through designated channels.

3. Coordinate the dissemination of information and availability of photography as needed to support information needs at the Federal, State, and local levels.

The tasking channels by which the Secretariat would accomplish its functions are in existence either by interagency agreement or by procedures established through OST. These tasking channels are described in Annex D.

The aerial photographic collection and photo interpretation resources required and available for tasking are described in Annexes A and C, respectively.

Systematic initiation of response actions and monitorship of information flow and handling are prerequisites to rapid data interpretation, analysis, and presentation. Information channels to staff and field disaster managers are likely to be omitted unless provided for. An illustrative diagram is shown in Exhibit II.

The need is imperative that immediate disaster effects information be in the hands of the Director, Office of Emergency Preparedness, as a basis for decisions and for briefing the President and heads of other departments and agencies of the government as required. To support this requirement, photographic interpretation reports and annotated photographs and briefing boards providing the essence of the overall disaster situation would be produced. Examples of these briefing boards developed around the Alaska Earthquake (1964), Hurricane Camille (1969), and the Lubbock, Texas tornado (1970) disasters are shown in Exhibits III through VII.

Finally, in the event of a coordinated commitment of resources under the conditions envisioned and as proposed in this report, an expenditure of funds by participating Federal agencies would be anticipated. Such expenditures may, in certain instances, be budgeted for, in others not. Upon a Presidential declaration of a major disaster, OEP may provide financial assistance in specifically designed instances from emergency funds allocated under Public Law 81-875. At the present time, until the general program described in this report has been approved, the expenditure of such emergency funds is not specifically provided for. It is necessary, therefore, that appropriate funding authorization be arranged for ahead of time.

The magnitude of costs likely to be incurred is not believed to be excessive--probably not exceeding $75,000 for all costs connected with a major disaster, say of the magnitude of Hurricane Camille. In the case of the photography flown over Lubbock, Texas, as an example, costs incurred for photo processing, copying negatives, printing, and making sets of enlargements for several agencies' use amounted to about $1,500. The flight mission was undertaken to support this program as well as in direct support of the scientific and technological objectives of the NASA Earth Resources Aircraft Program. Mission costs are sometimes difficult to arrive at because of the varying costing yardsticks (costs per flying hour, costs per square mile of coverage, use of commercial equipment versus government-owned equipment, military training missions, scientific and technical mission objectives, and so forth). However, $1,000 - $2,000 would

represent a not unreasonable estimate of direct dollar outlay. Charges for analysis and interpretation, preparation of illustrative materials, etc. were not incurred, but based on expended man-hour rates, $800 would be a reasonable estimate. So, in aggregate, if totally charged, out-of-pocket costs would have been of an order of magnitude of perhaps $4,000 - $6,000, allowing for additional photo processing needs and other expenses.

In a related and important area--not directly associated with any one particular disaster--but which provides necessary data for photo analysis of any and all such major disasters, is the need for acquisition and prepositioning of a pre-disaster photographic data base of large areas of the United States. Evaluation, plotting, and indexing of large amounts of this photography involves considerable effort at the evaluation and storage station, the USGS, SPO, Reston. Appropriate budget provision should be made to provide for this necessary support.

CONCLUSIONS

Five essential conclusions have emerged from the Task Group's discussions and findings; these are:

1. That severe natural disasters are a common domestic occurrence requiring rapid and effective response by Federal, State, and local governments; and that a systematic means for obtaining, interpreting, and presenting information from aerial photography is an essential first step in supporting these responses. Other disasters of man-made origin may require similar responses and rapid data utilization.

2. That significant capability exists within various Federal agencies and applicable to the coordinated collection, interpretation, and dissemination of aerial photographic information in support of national disaster evaluation and recovery activities. For example, NASA, ESSA, USDA, USGS, and DOD operate aerial photographic systems; USDA, ESSA, and DOD possess photographic interpretation capabilities, and USGS can provide a suitable common facility with some equipment support.

3. That it is feasible for relatively small and selected elements of those resources to be programmed for efficient utilization for short periods of time after a disaster strikes for aerial photographic interpretation of the data into useful information for use by those agencies needing it.

4. That a mechanism for the convergence of these resources in a common pool effort under OEP coordination to perform rapid disaster effects analyses is feasible and necessary to support prompt and responsive Federal decision-making actions.

5. That existing provisions for necessary expenditures and reimbursements of participating agencies in a common effort do not presently exist and are not currently budgeted for.

RECOMMENDATIONS

Based on the work, discussions, and conclusions of its members on subcommittees and as a group, the Task Group makes the following recommendations:

1. That provision should be made for the immediate initiation of aerial reconnaissance operations as may be required of the affected disaster area.

2. That provision should be made for the use of existing resources (aerial photographic data acquisition systems, data reduction, photo interpretation and analysis, and dissemination) available within the identified Federal agencies.

3. The mechanisms for the data acquisition, analysis, and other technical support shall be:

a. That the Office of Emergency Preparedness provide the alerting mechanism for the initiation of aerial reconnaissance operations if required, and for the associated interagency supporting operations required for rapid data reduction and analyses.

b. That the tasking of reconnaissance resources of the Government be accomplished in accordance with channels associated with existing interagency procedures, and those developed within the Office of Science and Technology, reflecting, where possible, the information requirements as recommended within the tasking documentation.

c. That the Department of Interior through the U. S. Geological Survey make the Special Projects Office at Reston, Virginia, as the focus of working activities and to provide such technical support as may be required, and that the Topographic Command of the U. S. Army Corps of Engineers be requested to provide such supplemental support when required.

d. That those agencies represented on the Task Group with available photographic interpretation personnel described in this report take such action as appropriate to identify a small number (say 2-3 per agency) of individuals possessing these skills for work assignments in a photographic interpretation pool to be convened on

call, as needed at SPO, USGS Reston. There is nothing implicit in this recommendation as with others above with respect to tasking these resources in competition with higher national requirements.

e. That information "feed-back" on aerial photographic missions and resultant photographic interpretation data accomplished in accordance with these recommended mechanisms be made available immediately by OEP to participating and other interested agencies.

4. That a small, permanent Secretariat be established within OEP and supporting its Disaster Operations Center to provide a continuing coordinative point of contact for the participating agencies, to provide other support and guidance as might be required when in an operational situation, and to assist in the preparation of necessary standard operating procedures for implementation of the foregoing recommendations.

5. That OEP, upon approval of this report, its concepts, and recommendations initiate appropriate program procedures to provide for budgetary support of anticipated expenditures.

6. That the Chairman of the ARGO Steering Committee secure the concurrences and approvals required for full implementation of the procedures outlined in this report.

REFERENCES

Letter, Director, OEP to Director, OST, December 15, 1969	Request for ARGO support
Letter, Director, OEP to Director, USGS, December 15, 1969	Request for USGS Reston Support
Letter, Director, OST to Director, OEP, January 23, 1970	Reply concurring with December 15, 1969 OEP letter
Letter, Director, USGS to Director, OEP, February 6, 1970	Reply concurring with December 15, 1969 OEP letter
Letter, Director, OST to ARGO Agencies, February 9, 1970	Establishing National Disaster Support Task Group
Public Law 81-875	Federal Natural Disaster Act of 1950 (as amended)
Public Law 89-769	Disaster Relief Act of 1966
Public Law 91-79	Disaster Relief Act of 1969
Executive Order 11490	Assigning Emergency Preparedness Functions to Federal Departments and Agencies - October 28, 1969
Executive Order 11495	Providing for the Administration of the Disaster Relief Act of 1969
Department of Defense Directive 3025.1, 18 November 1965	Employment of Military Resources in Natural Disaster Emergencies within the United States, its Territories, and Possessions
Corps of Engineers, U. S. Army: ER 500-1-1, 1 September 1967	Emergency Employment of Army Resources: Natural Disaster Activities

ANNEXES

A. PLATFORM RESOURCES

INCL. 1 National Aeronautics and Space Administration

INCL. 2 Environmental Science Services Administration

INCL. 3 U. S. Department of Agriculture

TABLE 1

TABLE 2

FIGURE 1 Map

INCL. 4 U. S. Geological Survey

B. TASKING CHANNELS

C. PHOTOGRAPHIC INTERPRETATION PERSONNEL AND DATA REQUIREMENTS

INCL. C-1 Sample Photographic Interpretation Report

D. COMMAND NETS

E. DISASTER TYPES AND INFORMATION REQUIREMENTS

TABLE 1

TABLE 2

INCL. E-1 Map

ANNEX A

PLATFORM RESOURCES

This Annex enumerates and describes available aerial acquisition systems available through the Department of Defense and certain of the National Civil Agencies that could potentially support national disaster evaluation and recovery operations.

The various sensor systems are described in the attached inclosures, each covering the resources controlled by a given agency. These are further subdivided by aerial platform and include the principal characteristics of the sensors associated with each. The Department of Defense has reconnaissance resources that would be suitable for acquisition of aerial photography and might be made available when appropriate to provide (some or needed) support, but the individual platforms and their sensor systems are not included in this report.

For information as to the means whereby support from the various systems can be requested, refer to Annex B, Tasking Channels.

Attachments

ANNEX A

INCLOSURE 1

National Aeronautics and Space Administration

The National Aeronautics and Space Administration operates several organic aircraft with various sensors in the Earth Resources Survey Program. In response to a request for disaster evaluation support, the probability is high that at least one aircraft would be over the area within 24 hours, able to obtain at least photographic coverage. At the present time, the photographic processing facilities available to the Earth Resources Aircraft program at the NASA Manned Spacecraft Center, Houston, Texas, does not have the capability for quick response (24 hours or less) for producing and delivering original negatives and duplicate materials. Normal processing requires two weeks, higher priority would require five days; however, under special circumstances (and in limited quantities) 24-hour turnaround has been obtained. However, under high priority conditions, turnaround time could probably be substantially shortened. Photography of Lubbock, Texas after the 11 May 1970 tornado was flown 1230 12 May, processed at MSC-Houston and available for shipment to OEP, 0900 13 May.

PLATFORM: Lockheed Electra - P3A (to 25,000 ft.)

Sensors:

1. RC-8 (2 each, stabilized)
   Type - Vertical Metric Frame Camera, 6" F.L.
   Swath - 74°, 2.8 miles at 10,000 ft.
   Scale - 1:20,000 at 10,000 ft.
   Resolution - 48 lines/mm approx. [redacted] STAT
   at 10,000 ft.
   Frame Size - 9" x 9"
   Number of Frames - 280/magazine
   Film - 9-1/2"

2. KA-62 (4 each, hard mount)
Type - Chicago Aerial Industries, 3" F. L.
Swath - 74°, 2.8 miles at 10,000 ft.
Scale - 1:60,000 at 15,000 ft.
Resolution - 53 lines/mm
Frame Size - 5"
Number of Frames - 2-1/2 frames/ft.; 625 frames color; 875 frames B&W
Film - 5"

3. Others - RS-14 Dual Channel IR Imager, IR Spectrometer, IR Radiometer, Scatterometers, SLAR, Multiple Frequency Microwave Radiometer

PLATFORM: Lockheed Hercules - NC-130B (to 30,000 ft.)

Sensors:

1. RC-8 (2 each, stabilized) (see characteristics above)

2. Hasselblad (6 each, hard mounted)
Type - Frame Camera

	80 mm	40 mm
Scale -	1:105,000 at 30,000 ft.	1:210,000 at 30,000 ft.
Coverage -	4.5 St. M. x 4.5 St. M at 10,000 ft.	9 St. M x 9 St. M. at 10,000 ft.

Resolution - 50 lines/mm
Frame Size - 70 mm x 70 mm
Number of Frames -
Film - 70 mm

3. Others - RS-7 IR Imager, Scatterometer, SLAR, Multispectral Scanner

PLATFORM: RB-57F (40-60,000 ft.)

Sensors:

1. RC-8 (2 each, stabilized) (see characteristics above)
14 NM swath at 60,000 ft.

2. Hasselblad (6 each, hard mount) (see characteristics above)

3. Zeiss - RMK-AR 30/23 Mapping Camera, 12" F.L.
   Type - Metric Frame Camera
   Swath - 37°, 11 NM at 60,000 ft.
   Frame Size - 9" x 9"
   Number of Frames - 450
   Film - 9.5", panchromatic, B&W infrared, color, color IR

4. Others - RS-7 Infrared Imager, Infrared Spectrometer, Infrared Radiometer

ANNEX A

INCLOSURE 2

Environmental Science Services Administration

ESSA maintains several aircraft with aerial photographic capability. ESSA would respond to a request for disaster evaluation support by scheduling specific missions or by incorporating OEP requirements into ESSA missions into disaster areas.

PLATFORM: DeHavilland Buffalo (to 25,000 ft.)

Sensors:

1. RC-8 (2 each)
   Type - Vertical Metric Frame Camera, 6" F.L.
   Coverage - 1.4 x 1.4 mi/frame, 157 linear miles/magazine x 6 magazines (B&W, IR), 56 linear miles/magazine x 6 magazines (Color) at 5,000 ft. (60% overlap and sidelap is standard; 10% - 90% available on request)
   Swath - 74°, 1.4 miles at 5,000 ft.
   Scale - 1:10,000 at 5,000 ft.
   Resolution - 48 lines/mm, approx. [redacted] STAT
   5,000 ft.
   Frame Size - 9" x 9"
   Number of Frames - 280/magazine (B&W, IR), 100/magazine (Color) x 6 magazines
   Film - 9-1/2" Plus-X 2402, Ektachrome 8442, Color IR 5424*

2. RC-9 (1 each)
   Type - Vertical Metric Frame Camera, 3.6" F.L.
   Coverage - 2.4 x 2.4 mi/frame, 250 linear miles/magazine x 6 magazines
   Swath - 120°, 2.4 miles at 5,000 ft.
   Scale - 1:17,000 at 5,000 ft.
   [redacted] STAT
   Frame Size - 9" x 9"
   Number of Frames - 280/magazine x 6 magazines
   Film - 9-1/2", Plus-X 2402

*Requires 40 hours to obtain film from source.

PLATFORM: Aero Command (under lease) to 22,000 ft.

Sensor: RC-8 (see characteristics above)

PLATFORM: DC-6

Sensor: P-2

Type - Vertical Frame Camera, 76 mm F.L.
Coverage - 0.67 x 0.67 mi/frame, 100 linear miles/ magazine x 4 magazines at 5,000 ft. (25% overlap)
Swath - 41°, 0.67 miles at 5,000 ft.
Scale - 1:19,000 at 5,000 ft.

STAT

Frame Size - 2-1/4" x 2-1/4"
Number of Frames - 210/magazine x 4 magazines
Film - 70 mm TRI-X 8403, Ektachrome 8442 (under full sun conditions)

ANNEX A

INCLOSURE 3

U. S. Department of Agriculture

The Forest Service owns 57 aircraft and uses by lease arrangement better than 1,000 more per year. Of these, eight Forest Service aircraft and six others available under contract are equipped for remote sensing (See Table 1, p. A-3-2).

Modern mapping cameras are available in USDA Regions 1, 4, and 6 and at the Pacific SW Research Station, Berkeley, California (See Table 2, p. A-3-3). Several old T-11 and K-17 cameras are on hand at these and other locations. The inventory also includes a variety of reconnaissance-type cameras which are used primarily for research, fire control, and insect and disease detection.

Tables 1 and 2 when used in conjunction and with the map (See p. A-3-4) identify in detail those platform and camera assets which are available for use in the various Regions.

Remote Sensing Platforms

TABLE 1

USDA Region	Type of Aircraft	Status	Max. Service Ceiling	Based at	Type of Opening
1	Beechcraft King Air	1/	25,000'	Northern Fire Lab Missoula	IR firescan mapping or camera
	Beechcraft (AT11)	2/	18,000'	Missoula,Mont.	Camera Hatch
	337 Cessna	2/ 3/		Missoula,Mont.	Camera Hatch
2	Beech Queen Air	FS*	26,000'	Denver, Colo.	Camera Hatch
4	Beech Queen Air	FS*	26,000'	Boise,Idaho	IR firescan mapping
	Aero Commander	FS*	20,000'	Ogden, Utah	Camera Hatch
	Cessna 310	2/	22,000'	Ogden, Utah	Camera Hatch
	Cessna Skylane	2/	14,000'	Ogden, Utah	Camera Hatch
5	Aero Commander	FS*	20,000'	Berkeley,Cal.	Camera Hatch
6	Beechcraft C-45	FS*	18,000'	Portland,Ore.	Camera Hatch
	Cessna 180	2/		Portland,Ore.	Camera Hatch
8	Aero Commander	FS*	20,000'	Atlanta, Ga.	Camera Hatch
	Beechcraft 99	FS*	27,000'	Atlanta, Ga.	Camera Hatch
9	Aero Commander	FS*	20,000'	Upper Darby,Pa.	Camera Hatch

1/ Renewable lease.

2/ Contract services.

3/ Availability uncertain.

* Forest Service

Reconnaissance Type Cameras Available

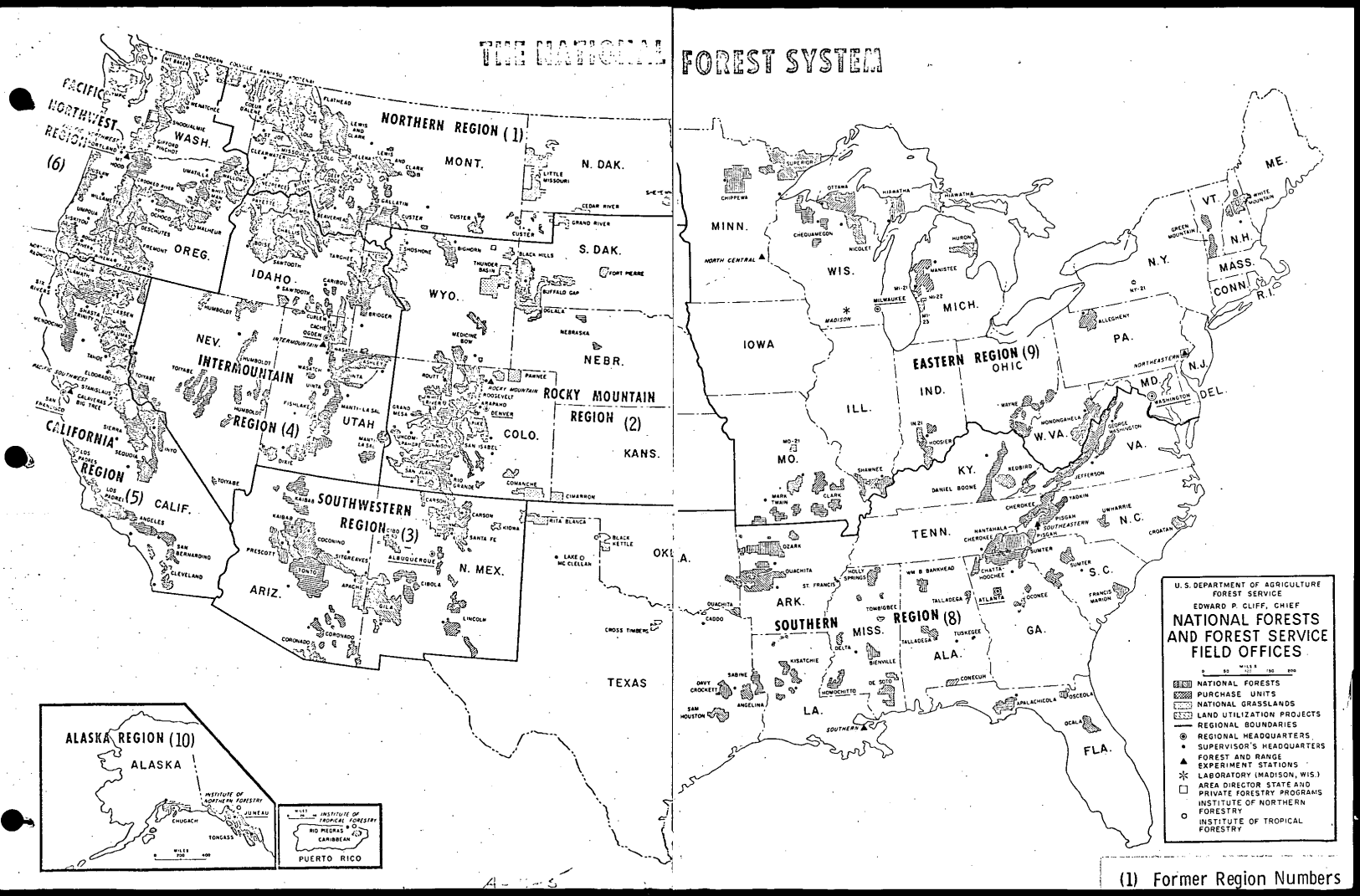
TABLE 2

USDA Region or Station		Manufacturer/Model		F.L.	Format	Film Size
1	2 each	Fairchild	K20	6 3/8"	4x5	5¼"
	2 each	Fairchild	K24			8"
3	(Fire Control) (on Forest)	Fairchild	K20	6 3/8"	4x5	4x5 Polaroid
	(Fire Control) (on Forest)	Fairchild	F8	10"	5x7	4x5 Polaroid
4		Fairchild	K20	6 3/8"	4x5	5¼"
		Fairchild	F8	15"	5x7	8"
		Fairchild) Panoramic)	KA54	3"		70 mm
PSW /	5 each	Maurer		3-1½" 2-3" 3-6" 1-9"	2¼x2¼	70 mm
		Hulcher		6" & 14"	2¼x2½	70 mm
		Fairchild	K20	6 3/8"	4x5	5¼"
	4 each	Fairchild	K25	6 3/8"	4x5	5¼"
			F56	8¼"	6 5/8 x 6 5/8	7"
5	3 each	Fairchild	K20	6 3/8"	4x5	5¼"
6	(I&D) o	Fairchild	F18	15"	5x7	7"
		Maurer		6"	2¼x2¼	70 mm
8	(S&P) Δ Alexandria, La.	Hulcher		12"		70 mm
	(S&P) Δ Valdosta, Ga.	Hulcher		12"		70 mm
	(S&P) Ashville, N.C.	Hulcher		12"		70 mm
	(S&P) Ashville, N.C.	Hulcher 6 lens		12"		(2 rolls of 70 mm) (3 exposures on each roll simultaneously)

/ Pacific South West Research Station, Berkeley, Cal.

o Division of Insects and Disease.

Δ State and Private Forestry.



ANNEX A

INCLOSURE 4

U. S. Geological Survey

The U. S. Geological Survey operates a number of aircraft based at Prescott, Arizona, which are available on 2-6 hour notice.

PLATFORM: Cessna 180 (to 12,000 ft.)

Sensors:

1. K-17 Mapping Camera (upgraded)
   Type - Vertical Metric Frame Camera, 6" F.L.
   Coverage - 360 NM
   Swath - 74°, 3 NM at 12,000 ft.
   Scale - 1:24,000 at 12,000 ft.
   Frame Size - 9" x 9"
   Number of Frames - 300 (B&W estar base film)
   Film - 9-1/2"

2. KA50A Camera
   Type - Vertical Metric Frame Camera, 1-3/4" F.L.
   Coverage - 684 NM
   Swath - 70°, 5.6 NM at 12,000 ft.
   Scale - 1:82,000 at 12,000 ft.
   Frame Size - 5" x 5"
   Number of Frames - 300 (B&W estar base film)
   Film - 5-1/2"

3. Sonne Continuous Strip Camera
   Type - low altitude, vertical mount camera, 6" F.L.
   Coverage - 1,000 NM
   Swath - 74°, 3NM at 12,000 ft. (9" format)
   Scale - 1:24,000 at 12,000 ft.
   Frame Size - 2-1/4" and 9" x continuous (9" being installed)
   Number of Frames - NA
   Film - 70 mm and 9-1/2" (being installed)

PLATFORM: De Havilland Beaver (U6) (to 15,000 ft.)

Sensors:

1. K-17 Mapping Camera (see characteristics above)

2. KA50A Camera (see characteristics above)

3. Hasselblad EL 500 System
   Type - hand-held or vertical mount, 80 mm and 40 mm F.L.
   Coverage - 50 NM in vertical mount
   Swath 47°, 1.8 NM at 15,000 ft. (80 mm lens)
   Scale - 1:57,000 at 15,000 ft. (80 mm lens)
   Frame Size - 2-1/4" x 2-1/4"
   Number of Frames - 70
   Film - 70 mm

4. Others - HRB Singer Imager, RS-9 Imager, Multispectral Orthocon-type TV System, Thermal Radiometer

PLATFORM: Cessna 310D (U-3) (to 16,000 ft.)

Sensors:

1. KA50A Camera (see characteristics above)

2. Sonne Strip Camera (see characteristics above)

3. Hasselblad EL 500 System (see characteristics above)

4. Others - HRB Singer Imager, RS-9 Imager, Multispectral Orthocon-type TV System, Thermal Radiometer

PLATFORM: T-33 Jet Trainer (to 35,000 ft.)

Sensors:

1. KA50A Camera (see characteristics above)

2. Hasselblad EL 500 System (see characteristics above)

3. Others - Imaging equipment and TV systems will be available by July 1970

PLATFORM: Sikorsky H-19 Helicopter (to 7,000 ft.)

Sensors:

1. Motion Picture Camera (16 and 35 mm)

2. Other - IR Radiometer, Optical Spectrometer, Fraunhofer Line Discriminator, TV Equipment, Sampler (for bottom and water samples).

ANNEX B

TASKING CHANNELS

Channels for tasking at interagency levels by the Office of Emergency Preparedness are indicated below. Existing Federal disaster legislation, Presidential directives, as well as internal directives and regulations, for Federal agency support (both civil and military) provide authority for the Director, OEP, as may be required or deemed necessary.

The time available to secure approval of requests for support will probably be critical; therefore, in order to insure expeditious action, oral requests should be acted upon and back-stopped, when appropriate, by written requests.

The principal focus within OEP for the initiation and coordination of aerial photographic requirements will be within the OEP Disaster Operations Center when it becomes activated in a serious disaster situation.

Specific Tasking Channels

1. Department of Agriculture

Support by the Department of Agriculture must be secured by a request from the Director, OEP (or his designated representative) to the Secretary of Agriculture (or his designated representative).

2. Environmental Science Services Administration

Support by ESSA must be secured by a request from the Director, OEP to the Administrator or the Deputy Administrator of ESSA (or their designated representatives).

3. Department of the Interior

Support by the Department of the Interior must be secured by a request from the Director of OEP to the Director of the U. S. Geological Survey (or their designated representatives). Inquiries

for information on available and/or operational status of the aircraft should be made to any of the following at the Phoenix Office, 602-261-3456, the Prescott offices, 602-445-7312 or 602-445-6510, or at home telephones:

STAT

4. National Aeronautics and Space Administration

Support by NASA must be secured by a request from the Director, OEP (or his designated representative) to the Administrator of NASA (or his designated representative).

5. Department of Defense

Support by DOD should be secured by a request from the Director, OEP (or his designated representative) to the Reconnaissance Division, Special Activities Office, Defense Intelligence Agency (DIAXX-1).

Contract photographic coverage secured by the Corps of Engineers will be made available through the Secretary of the Army.

ANNEX C

PHOTO INTERPRETATION PERSONNEL, EQUIPMENT, AND DATA REQUIREMENTS

Specifications for pre- and post-disaster photography, photo interpretation equipment, photo interpreter and graphic arts skills are discussed in the following. In order to make expeditious use of existing data base material and post-disaster aerial photography for quick response damage assessment studies, the availability of skilled personnel and supporting photo interpretation equipment must be identified. Accordingly, such personnel and equipment available at the Special Projects Office (SPO) USGS, Reston, as well as numbers of skilled personnel from various government agencies and available for possible emergency assignment to SPO USGS, Reston are identified. Additional equipment which may be utilized is indicated.

1. Imagery

a. Systems

The prime interest system is a fixed frame, long focal length camera system of the largest format available. Data reduction equipment is generally available to accommodate such a system, and the data handling is minimized. Alternate systems of interest are the panoramic systems with higher resolution and extended format in the cross-flight direction. In areas of extreme cloud cover, side-looking radar may be utilized. Operational availability of the particular systems at the time needed will determine the system and format to be utilized.

Other sensors, such as multispectral scanners, microwave radiometers, et al, are not considered as operational sources of information for national disaster applications at this time. If, however, these types of sensors are available on the platform used to acquire photography, they should be operated to obtain information in support of specialized operations and in conjunction with the photographic data to develop techniques for eventual operational use.

b. Films

Photo interpretation for disaster applications is adequately served in most cases by the use of B&W panchromatic emulsions with enhanced red response on a stable base film. When used with appropriate filters, this combination will perform adequate

haze penetration. Other films having possible applications would be color, black and white IR, and color IR.

c. Flight Considerations for Aerial Photography

The scale will be determined by the operational ceiling of the vehicle and the camera system. The platform should be as near vertical as possible. End lap and side lap for the photography should be the normal 60% and 30%, respectively.

Weather conditions following a disaster will have a major bearing on how rapidly aerial photography may be obtained and at what flight altitudes. The principal weather factors affecting aerial photography are clouds, turbulence, and haze. In the case of tornadoes, conditions are usually suitable for aerial photography by the following day. Hurricanes, severe coastal storms, and heavy winter storms, on the other hand, usually have substantial amounts of clouds remaining for 24 to 36 hours. In these latter cases, it may be necessary to use relatively low flight altitudes to obtain coverage in the immediate post-disaster period.

Aerial photography should normally be exposed when the sun angle exceeds 30 degrees. For example, reflectance from low-sun angle, especially over water (as for oil slicks), causes glint which attenuates the image on the photograph. Photography taken with low sun angle also causes excessive shadow areas over land and especially over mountainous areas, and should be avoided.

d. Photographic Processing Equipment

(1) SPO USGS, Reston has equipment required for the support of the photo interpretation teams. The photolab is equipped for black and white film only. Photolab equipment includes:

Contact Printers

LogEtronics and Morse in 9" x 9" and 9" x 18" format

Rectifier

Wild E-4

Enlargers

Wild VG-1 in 9" x 9" format
Kodak 10X-20X-40X

Copy Camera

Large-Frame for film and plate to 48" x 48"

Processing Equipment

24" automatic photo processor
Photo processing trays up to 5' x 7'

(2) The Agricultural Stabilization and Conservation Service (ASCS) of the Department of Agriculture lists the following data on processing equipment available in their Asheville (A) Laboratory or their Salt Lake City (SL) Laboratory:

Laboratory		Film and Print Processors	
A	1	Kreonite - 42" Model 5412A	Sheet or Rolls
SL	1	Kreonite - 42" Model 5412A	Sheet or Rolls
SL	1	Kreonite - 24" Model 5412A	Sheet or Rolls
A	1	RT-24	Sheet or Rolls
A	1	RT-12	Sheet or Rolls
A	1	Pako G-24-3	Sheet or Rolls
SL	1	Pako G-24-3	Sheet or Rolls
SL	1	EH-6A-Houston-Fearless 9"	Rolls Only
SL	1	Sepratron 9" Houston-Fearless	Rolls Only

		Contact Printers	
A	2	LogEtronic Mark II	lw/roll paper transport
SL	2	LogEtronic Mark II	lw/roll paper transport
A	2	LogEtronic CP-18	
SL	2	LogEtronic CP-18	

		Enlargers for Aerial Photography	
A	2	Foster ASCS-2 Rectifier	(6X Max)
SL	2	Foster ASCS-2 Rectifier	(6X Max)
A	4	Saltzman 124 Rectifier	
SL	4	Saltzman 124 Rectifier	
A	1	Saltzman B-9	
A	1	Zeiss SEGV Rectifier	
A	1	Kargl R-56 Rectifier	
SL	1	Kargl R-56 Rectifier	
A	1	Saltzman Horizontal Enlarger	(23X Max)
SL	1	Saltzman Horizontal Enlarger	(23X Max)

(3) The Forest Service of the Department of Agriculture lists the following data on processing equipment available in the Regions indicated (see Map, Inclosure 1 to Annex A):

Forest Service Region	Film Processors
1	2 Morse wind-rewind processors used regularly for B&W
4	4 B&W wind-rewind processors
4	1 Zeiss rewind system for color
	Contact Printers
1	1 Morse, 1 LogEtronic Mark II
2	1 Morse, 1 9" x 18" Morse
4	2 LogEtronic Mark II, 1 LogEtronic Mark III (for color), 1 LogEtronic Mark II R5A continuous strip printer with step and repeat printing mode
5	1 Morse, 1 LogEtronic Mark II
6	1 Morse (not used), 1 "old" LogEtronic
W.O.*	2 Morse, 1 LogEtronic CP-18, 1 LogEtronic Mark II
	Film and Print Processors
1	Eastman Supermatic due by June 1, 1970
4	Eastman Supermatic
4	Eastman 4 CT Color Processor
6	Eastman Supermatic
	Enlargers for Aerial Photography
1	HE 12 (max. 12x enlargement)
2	Saltzman (5x enlargement)
4	2 each Durst Color Enlargers
5	Ellwood (max. 4x enlargement)
6	Zeiss Seg. V (4-1/2x enlargement)
W.O.*	Ellwood (7" x 9" max. negative size) Saltzman 6x enlargement Levi 301 Vertical Enlarger (various lenses)

* Washington, D. C. Office

e. Products

The original negatives and two duplicate positive film transparencies from the disaster photography should be delivered to the disaster photo interpretation team as early as possible. SPO, USGS does not have facilities to prepare these products rapidly. The collection agency should transmit the unprocessed film or negative through appropriate channels for processing and preparation of the duplicate positive prints. The original negative is desirable for preparation of paper prints and enlargements. The duplicate positive film transparencies are necessary to allow parallel interpretation by the various members of the photographic interpretation team.

2. Post-Disaster Photo Interpretation Data

a. Photo Interpretation Reports

The categories of photo interpretation for disaster uses essentially cover the broad spectrum of civilian photo interpretation, and since the work effort is oriented towards a 12-24 hour response, the photo interpretation will of necessity be limited in scope but highly accelerated in application. The results of this analysis in verbal, written, and graphic forms would be made available in as short a time period as possible, to the Director, OEP through the medium of his Disaster Operations Center at OEP Headquarters, Washington, D. C. At this focal point, available data on all aspects of the disaster would be analyzed and presented for information and disaster management and coordination with other Federal, Regional, State and local officials. Follow-up and in-depth photo interpretation for comprehensive disaster analysis is within the mission of the various civilian agencies of the Federal Government. They will perform this analysis in the course of their normal activities in this regard, and possibly will require additional and special aerial photography. The initial disaster photography, other photographs, maps, and other materials will be made available to these agencies at the SPO, USGS.

The initial task of the photographic interpreter group is to examine photography as rapidly as possible after film receipt to report all possible information on conditions in the disaster area and to provide an initial assessment of damage in textual and graphic forms insofar as the imagery permits. The prime purpose will be

to provide photography-derived information contributing to answering such disaster-oriented questions as those indicated in the list below. It will be noted that estimates of such effects, for example, as the extent of personal injuries to the inhabitants, availability of clothing and drug supplies, and quality of drinking water supply would be speculative. Therefore, emphasis is placed upon reporting those critical and immediately needed elements of information which are uniquely observable and reportable from the visible photographic evidence.

(1) General Damage Assessment

(a) Synoptic view of the area and extent of damage
(b) Severity and type of damage
(c) Current status of the disaster (i.e., fires still burning?)

(2) People-associated Problems

(a) Public Subsistence Needs

1. Destroyed and damaged housing (homes, motels, trailers, etc.)
2. Food supplies--warehouses and processing plants

(b) Condition of Utilities

1. Communications
2. Water service
3. Electric power
4. Gas supply
5. Sewage problems
6. Fuel supplies for vehicles and emergency equipment (pumps, etc.)

(c) Medical

1. Damage to area medical facilities (hospitals, clinics, etc.)

(3) Transportation

(a) Highway and road conditions
(b) Railroad conditions
(c) Airfield conditions

(d) Harbor conditions
(e) Damage to bridges and tunnels
(f) Best highway access
(g) Other means of access

(4) Property Damage--Public and Private

(a) Structures (government, industrial, commercial, residential, agricultural)
(b) Contents (including equipment)
(c) Land (washed out, flooded, buried by slides, etc.)

Following each disaster where photography is requested and obtained, photo interpretation reports (See Inclosure 1) and annotated photo enlargements or mosaics will be prepared (See Exhibits III-VII).

b. Photo Interpretation Resources

The number of persons who would be made available to SPO, USGS for facility support and photo interpretation is indicated as follows:

U. S. Geological Survey

Special Projects Office*	50 persons (for facility support)
Geology Division	11
Water Resources Division	6
Conservation Division	3
EROS Staff	2

*SPO has a capability for preparing graphic presentations (briefing boards, "spectaculars," etc.) as required for disaster status reporting.

U. S. Department of Agriculture

Forest Service	3

U. S. Department of Commerce

ESSA	3

Department of Defense

Defense Intelligence Agency 6 (with supervisor)

U. S. Army TOPOCOM:

Professionals in following fields: forestry, geology, geography, engineering, etc., with photo interpretation backgrounds can be made available in teams of five to seven persons with supervisors. These teams can be designated beforehand and made available upon request.

c. Supporting Equipment

Various type viewing instruments are available at SPO, USGS. These include:

Viewers

2 Itek viewers with 36" x 36" screen, accepting film widths from 35 mm to 9-1/2", with enlarging capability of 3, 6, 12, and 30 times magnification

1 Richardson viewer with 36" x 36" screen, accepting film widths of 35 mm and 77 mm

1 Opto-Mechanism fibre-optics viewer measuring instrument, accepting film widths up to 9-1/2" and 9" x 18" formats, and coordinate measuring capability to an accuracy with a standard error of about 40 micrometers

Light Tables

Several Richards photo interpreter light tables with B&L P.I. stereoscopes

Mensuration and Plotting

1 K 200 stereo plotter for 9" x 18" format
1 305/1220 stereo plotter for 9" x 18" format
1 Kelsh plotter for 9" x 9" format
1 Mann comparator for 9" x 18" format

Computer

IBM Model 1130

ANNEX C
INCLOSURE 1

OFFICE OF EMERGENCY PREPAREDNESS
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D. C.

IMMEDIATE PHOTOGRAPHIC INTERPRETATION
DAMAGE ASSESSMENT REPORT # _____; DATE: _____

EVENT: DATE: _____

AREA/LOCATION:

PHOTOGRAPHIC MISSION: ; DATE: _____; F. L. ____; ALT: _____

GENERAL:

REPORTABLE DAMAGE TO:

HOUSING:

TRANSPORTATION:

UTILITIES AND SERVICES:

MEDICAL FACILITIES:

COMMUNICATIONS:

PUBLIC BUILDINGS:

REMARKS:

DISTRIBUTION:

INTERPRETED BY: _____

APPROVED BY: _____

ANNEX D

COMMUNICATION NETS

This Annex identifies the communications and the designated points of contact within participating agencies for use in requesting photography and for other support as required. Its primary purpose is to insure expeditious response from agencies tasked (See Annex A) for acquisition of aerial photography of disaster areas--imminent or present; to inform user agencies that photography is being flown; to advise of its availability; and to initiate actions for photographic interpretation, photo processing, and other related work (See Annex C).

OEP, as coordinator of Federal and State activities relative to natural disaster response, centralizes control and issuance of direction and maintains knowledge of how support programs in the disaster area are progressing. Its newly established Disaster Center, to which this program will provide support, will be the focus of action requests of OEP for photography by user agencies, information on direct, initiative acquisition by user agencies, as well as the coordination of arrangements for distribution of photography and photo-derived information and reports.

1. Standard Communications: Requests for acquisition of photography can be passed over the regular commercial lines, utilizing local or Federal Telecommunication System (FTS) for the various offices to be contacted.

2. Emergency Communications: Where there is no direct tie-in with the department or agency, it may be necessary to use alternate communications channels. Where necessary, Department of Defense nets, including AUTOVON and those available to the Office of Civil Defense, may be used. Each of the aerial photographic collection agencies has communication nets down to its lowest components. In most cases, commercial leased lines for both telephone and two-way teletype would be used. Alternate secure systems (where available) and when needed could be utilized.

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ANNEX E

DISASTER TYPES AND INFORMATION REQUIREMENTS

The primary use of imagery will be to provide information as rapidly as possible to the Director, OEP. Concurrent use will be made of the coverage by all Federal agencies responsible for assigned disaster relief and emergency reaction missions. As stated in Annex C, many agencies would also use the imagery for normal mission-related activities not directly concerned with Federal agency disaster assessment and relief programs.

Information regarding incidents of sufficient severity to be categorized as National Disasters is contained in a computer-based information file maintained by OEP. From 1953 to May 1970, there have been 293 Presidential declarations of National Disasters. Some of these incidents, their principal causes, expenditures, and location by States are listed below in Table 1. (Also see Map, Inclosure E.)

ANNEX E

TABLE 1

TYPE AND NUMBER	EXPENDITURE (millions)	STATE			
Flooding					
187	241.9	Calif.	13	La.	3
		Texas	11	N.J.	3
		W. Va.	9	N. Mex.	3
		Iowa	9	Ohio	3
		Ark.	8	Penn.	3
		Minn.	7	Wis.	3
		Ky.	7	Hawaii	2
		Neb.	7	Mont.	2
		Nev.	7	N. Car.	2
		Idaho	6	Tenn.	2
		Mo.	6	Vt.	2
		Ill.	6	Ala.	2
		N. Y.	6	Ariz.	1
		Okla.	6	Alaska	1
		Kansas	5	Conn.	1
		S. Dak.	5	Del.	1
		Colo.	4	Fla.	1
		Ga.	4	Me.	1
		Ind.	4	Md.	1
		N. Dak.	4	Mass.	1
		Ore.	4	Miss.	1
		Va.	4	R.I.	1
		Wash.	4	Wyo.	1
Tornadoes					
44	35.5	Tex.	4*	Calif.	1
		Kan.	5	Colo.	1
		Ark.	4	Ind.	1
		Mich.	4	Iowa	1
		Ill.	4	Mass.	1
		Ohio	3	Me.	1
		Okla.	3	N. Dak.	1
		Ala.	2	Miss.	1
		Ga.	2	S. Dak.	1
		Ky.	2	Tenn.	1
		Mo.	2	Wis.	1

(* Not including Lubbock, Texas, May 1970)

TYPE AND NUMBER	EXPENDITURE (millions)
40	100.8

La.	6	R.I.	2
Fla.	5	S. Car.	2
N. Car.	4	Ala.	1
Texas	4	Ga.	1
Conn.	2	Hawaii	1
Mass.	2	Me.	1
Miss.	2	Md.	1
N. Y.	2	N. J.	1
Penn.	2	Puerto Rico	1

Timing requirements for imagery are dependent on the types of disasters, are sometimes critical, and are listed in Table 2. Requirements for coverage of imminent or post-disaster situations include:

a. In a developing situation (needed to maintain surveillance of potentially critical situations):

Ice jam buildup
Abnormal snowpack buildup and melting
Drought development
Flooding
Forest fires
Volcanic eruptions
Winter storms

b. During prolonged disaster periods (periodic imagery needed to maintain surveillance and possibly assess effects):

Snowpack melt flooding
Flooding
Drought
Forest fires
Volcanic eruptions
Winter storms

c. Immediate post-disaster (needed to provide critically needed information for assessment of damage, historical data, and analysis of changes):

Flooding (flash or otherwise)
Coastal storms
Tsunami
Hurricanes/typhoons
Tornadoes
Earthquakes/landslides

Following a photographic mission of a disaster area, there may be need for 1:12,000 or larger scale imagery for planning, effects assessment and other work purposes at field command posts in the disaster zones. Enlargements of photographs can be made to suitable scales required to facilitate disaster recovery operations or to fulfill other priority requirements.

In some cases, true color or color IR imagery is preferable to B&W for assessing certain effects to enhance photo interpretation, e.g., snowpack areas and marine oil pollution. However, length of time for processing color film and the limited processing capabilities within the local Federal agencies restrict current use of these film types.

As an example of critical need, immediately available imagery of Hurricane Camille damaged areas could probably have been utilized by the following agencies in assisting them to meet some of their disaster relief assignments:

Office of Emergency Preparedness (OEP): National level and field operations coordination.

Bureau of Public Roads (BPR): Planning highway clearance and rehabilitation.

Corps of Engineers (CE): Debris clearance projects.

Housing and Urban Development (HUD): Location of trailer sites and emergency shelters; plan restoration of public utilities.

Health, Education, and Welfare (HEW): Planning for repair and restoration of schools.

Department of Agriculture (USDA): Status of food storage and processing facilities, timber clearance, and planning for train and ship (food cargoes) diversion.

TABLE 2

	Disaster Types	When Required	Use to be Made of Imagery
1.	Ice Jam Flooding	When Forming and Subsequent	Flood Fighting Measures: CE Flood Forecasting: ESSA
2.	Abnormal Snowpack Flooding	Nov-Mar Monthly Mar-Weekly & as Rqd. Spec. Areas	Flood Forecasting: ESSA Guidance of Field Parties: ESSA, CE, USDA
3.	Heavy Continuing Rain; Flooding	Peak Flood	Damage Assessment: CE, ESSA, USDA Stream Changes: USGS, ESSA Establish Contours: CE
4.	Flash Flooding	Post Flood Immediate	Same as Above
5.	Coastal Storms - High Tides	Post Storm Immediate	Damage Assessment: CE, USDA Stream Changes and Historial Data: USGS, ESSA
6.	Tsunami Coastal Damage	Post Incident	Damage Assessment: CE, USDA Historical Data and Assessment Changes: USGS, ESSA
7.	Hurricane-Typhoon Coastal Damage	Post Incident	Damage and Storm Assessment and Verifications: CE, ESSA, USDA Historical Data and Assessment Changes: USGS, ESSA

	Disaster Types	When Required	Use to be Made of Imagery
8.	Hurricane-Typhoon Inland Flooding and Damage	Post Incident Immediate	Damage Assessment: CE, ESSA Storm Assessment and Verification: ESSA, USDA, USGS
9.	Tornadoes; Urban Damage	Post Incident Immediate	Damage Assessment: CE, ESSA, USGS Storm Assessment: ESSA
10.	Tornadoes; Agricultural Damage	Immediate	Damage Assessment: USDA, ESSA Storm Assessment: ESSA
11.	Earthquake Urban Damage	Immediate	Damage Assessment: CE Historical Data: USDA, USGS Identify Changes: ESSA
12.	Earthquakes; Massive Land Displacement	Immediate	Damage Assessment: CE, if required Historical Data: USDA, USGS Identify Changes: ESSA
13.	Dam Failures	Immediate	Damage Assessment: CE, USDA
14.	Drought	As Conditions Develop	Relief Measures: USDA, HEW Extent and Magnitude: ESSA
15.	Forest Fires	As Conditions Develop	Planning, Fire Detection and Control: USDA
16.	Explosions (e.g., Texas City Type)	Immediate	Disaster Relief: All Federal Agencies interested
17.	Volcanic Eruptions and Lava Flows	Immediate	Disaster Relief: All Federal Agencies interested. Identify Changes: ESSA, USGS

	Disaster Types	When Required	Use to be Made of Imagery
18.	Radiological Disasters	Immediate	Contamination Control and Disaster Relief: USDA, AEC, ESSA
19.	Railroad Wrecks	Immediate	Depending on Situation: DOT
20.	Urban Conflagration (e.g., Riot Caused)	Immediate	Damage Assessment
21.	Winter Storms, Heavy Snow, Ice Storms		Disaster Relief: USDA, CE Damage/Flood Potential Assessment: ESSA, USGS
22.	Landslides and Avalanches (Slides, Falls, Flows)		Damage Assessment: USDA, ESSA, CE Identify Changes; ESSA, USGS
23.	Pollution (e.g., Air, Water and Land)		Damage Assessment: USDA Prediction of Movement: ESSA, CE

NOTES: Imagery and information obtained is of interest to OEP. Particular incident and timing will determine specific imagery requirements.

Immediate requirements will be black and white imagery; post incident - other types may be desirable (e.g., color infrared, black and white infrared, true color).

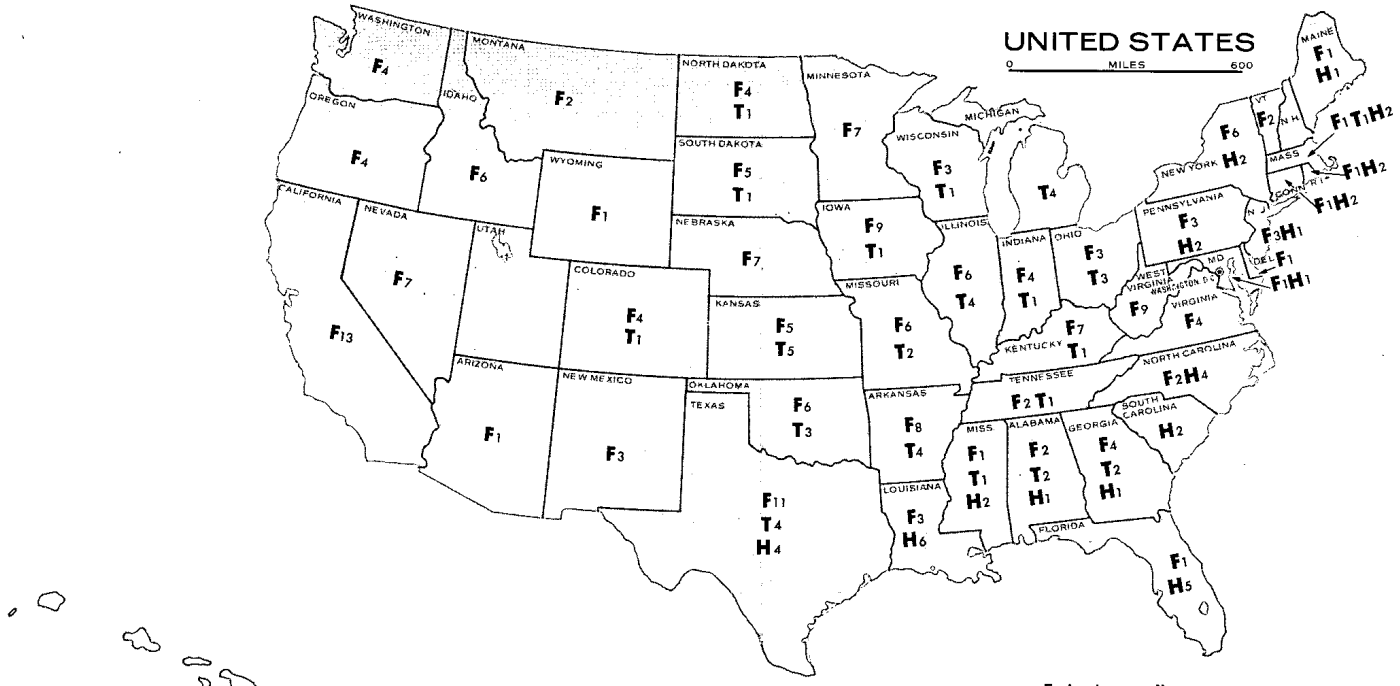
Imagery will be made available as required to other concerned departments and agencies, depending on type of disaster, i.e., HEW, HUD, AEC, DOT, FWPCA.

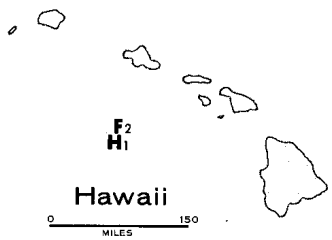
Imagery to be of such quality as to detect an object on the ground with a minimum size of 6'-8'.

ESSA requires metric quality photography, usually in color, preferably at a scale of 1:5000 to support its geodetic control activities and preparation of nautical charts. Photography of lesser quality and other scale is very useful to identify areas required higher quality photography and as a basis for issuing revised chartlets immediately following a disaster.

Declared Natural Disasters Since 1953

This report covers 243 declarations of the types listed in the key. They were selected from a file of 293 declarations containing other such types as earthquake, fire, drought, etc. The Lubbock, Texas, declaration is not included in this report.





Disaster*		Federal expenditure (millions)
F	Flooding	$242
T	Tornadoes	$35
H	Hurricanes	$101

Denotes number of disasters

*"Flooding" includes flooding with or without tornadoes and hurricanes "Tornadoes" includes tornadoes with or without flooding. "Hurricanes" includes hurricanes with or without flooding.

99289 7-70

EXHIBITS

EXHIBIT I

HURRICANE "CAMILLE" PHOTOGRAPHIC INTERPRETATION STUDY

HURRICANE "CAMILLE"

An Appreciation of the Damage As Interpreted from Aerial Photography

by

[redacted] STAT

Resource Evaluation Division
National Resource Analysis Center
Office of Emergency Preparedness

August 29, 1969

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[redacted] Earth Resources Program, NASA Headquarters, and to other individuals there and at the NASA Manned Spacecraft Center, Houston, for initial efforts and "alerts" as to availability of Camille imagery; STAT

[redacted], Emergency Operations Office, Corps of Engineers, U. S. Army, for his efforts leading to the acquisition of this photography; STAT

And to others in OEP, USGS, the Department of Agriculture whose encouragement and support has been most helpful.

FOREWORD

As the media reports became available describing the extent of the devastion along Mississippi coastal areas and initial uncertainties as to details and specifics, it was almost a "reflex" to make inquiries as to: (a) existence and availability of aerial coverage of the area involved, and (b) requirements placed by OEP or other Federal agencies for such coverage. As an indication of similar concern, several inquiries had been received by the author during this period from Federal and private sources as to the need for and the existence of coverage.

Our first formal inquiries starting August 25 were discouraging, indicating uncertainty as to availability and requirements for same. Fortunately, these initial reports were unfounded. Further information revealed that indeed the Corps of Engineers had requested area coverage of the U. S. Air Force, presumably for area surveys, engineering works applications, rehabilitation, and relief purposes. By August 26, it had been determined that a complete set of the coverage was in Washington at the U. S. Topographic Command. Also, that NASA, Houston had utilized its Earth Resources Aircraft to flying over the area with a variety of sensor equipment (color, color infra red, and black and white photography). Steps were taken to gain access to the Corps of Engineers coverage as well as the NASA imagery. By Wednesday morning, August 27, a complete set of duplicate positive film (20 cans) had been delivered to the USGS facility at Reston, Virginia for use by those Federal agencies with needs so to use it. Similar arrangements were made to acquire copies of the NASA film. Arrangements were then made to view the material at Reston. By close of business August 27, a selection of the photo exposures for annotation and enlargement, and an initial interpretation of major damaged areas had been accomplished.

The principal purpose in presenting this study, preliminary as it is, is to demonstrate a quick reaction capability that is available to those Federal, State and local agencies with the need for it. As these agencies are suddently confronted with disaster management problems of great magnitude, one of their earliest requirements is for definitive information. The aerial photographic medium is a source of information which is capable of providing much of this needed information and in a fairly rapid time sense.

In this spirit the following illustrated report was undertaken. It does not attempt to present a detailed analysis of area or local damage effects. Several areas were chosen for analysis and illustration. Much more damage than described was visible in the photography and therefore reportable. For example, the residential areas in Gulfport and Pass Christian selected for annotation, represent large and very obvious areas of contiguous damage. Adjoining areas along the water front and further inland had suffered almost equally from the severity of flood waters and wind. More detailed interpretation would develop these areas as well.

Photographic Notes:

USAF coverage: Mission Camille, August 21, 1969, scale: approx. 1:27,000.

NASA coverage: (Not yet available at this writing.) Flown August 19, 20, 1969; several missions; high and low altitudes; coverage with black and white, color, infra red, black and white infra red.

Gulfport, Mississippi — Exhibit A

Gulfport Harbor Area — Exhibit A-1

Note: 1. (3) beached ships - 450 ft - 490 ft length

2. Breakwater and yacht basin - breached dolphins and piers; absence of small boats.

3. Damage and destruction of buildings on wharves and piers. Roughly 15-20 warehouses and other buildings damaged or destroyed.

Residential Area — Exhibit A-2

Beach front residential area 1-2 miles in length with almost complete destruction of housing.

U. S. Naval Reservation — Exhibits A-3, A-4

6 large warehouse buildings (550' x 110') almost totally damaged

4 warehouses (230' x 90') destroyed

17 warehouses (185' x 40') severely damaged

Pass Christian, Mississippi — Exhibit B

From the photographs, it would appear that this small town along the gulf-front was almost completely washed out. Dwellings have been washed away or from foundations and deposited considerable distances away; barges are observed 1-2 miles inland, etc.

Residential Section — Exhibit B-1

An area of major destruction. Of more than 200 buildings previously standing, about 1/2 appear to have been destroyed.

Highway Bridge — Exhibit B-2

Highway Bridge about 2 miles north of Pass Christian crossing Bayou Portage, was partially damaged. One span is out and damage is visible on another.

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Remarks

The foregoing interpretation report is very cursory. As noted in the foreword, it attempts to demonstrate graphically the wealth of information in the aerial photographic imagery that is available to disaster managers, and to indicate the relative facility and rapidity with which data can be developed.

The extraction of information presents little or no problem save that required to assemble photographic interpreters and to put them to work analyzing the photography. Upon receipt of disaster coverage of an area of this magnitude, an information report could be ready for dissemination within an hour or two. Follow-up detailed reports, somewhat longer. Photographic interpretation skills are readily available within the Federal establishment in the Washington area. They are available to a lesser extent at State and local levels within regional and other offices of USDA, USGS, Corps of Engineers and others. It becomes a matter of delineating the work needed and getting it underway.

Perhaps the two most pointed observations to be made from this study are:

1. The almost uniform interest, cooperation and support in making the fullest use of aerial photographic and other sensor imagery under the disaster conditions created by Camille.

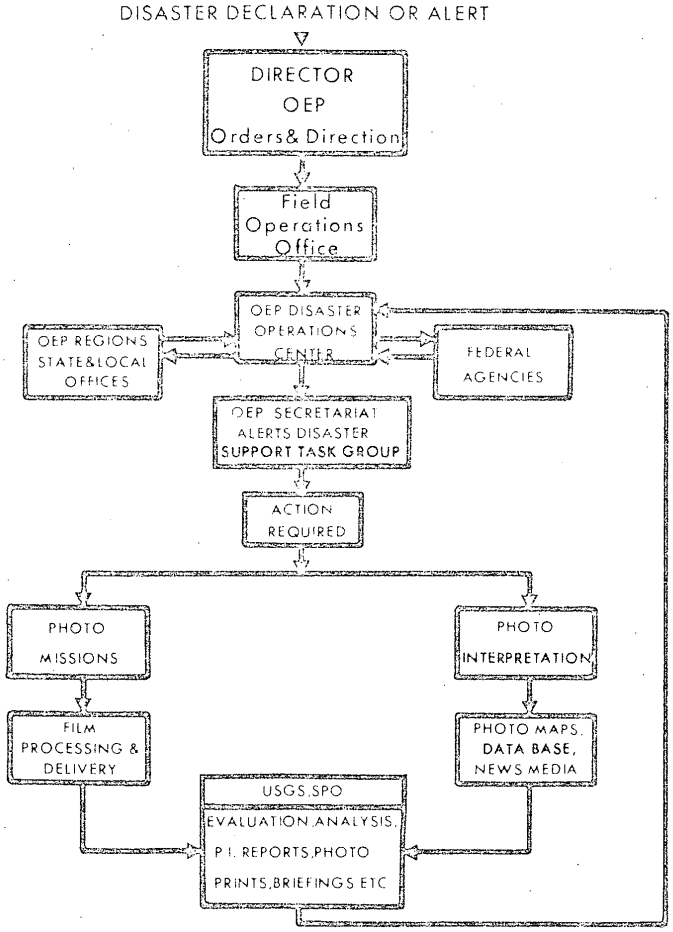
2. The apparent lack of a visible and coordinated effort to develop uniform requirements for disaster aerial surveys; to report on the availability of same; and the generation of a common requirement for the information contained therein.

It is noteworthy that elements of the Federal establishment accustomed to utilize photographic survey information are currently discussing the establishment of formal procedures for future use in this connection. It is the opinion of the author that OEP should provide the coordination element.

EXHIBIT II

SYSTEM FLOW CHART

DISASTER SUPPORT SYSTEM



UPON DECLARATION OF A DISASTER OR UPON ACTIVATION OF THE OEP DISASTER OPERATIONS CENTER BECAUSE OF IMMINENCE OF A MAJOR NATURAL DISASTER OR OTHER REASON, THE TASK GROUP SECRETARIAT, UPON CONSULTATION WITH THE DIRECTOR, OEP, OR THE DIRECTOR, FIELD OPERATIONS OFFICE, WILL ALERT THE TASK GROUP MEMBERSHIP.

DECISIONS, BASED UPON AVAILABLE INFORMATION AS TO THE CHARACTER AND EXTENT OF THE DISASTER, WILL BE MADE AS TO REQUIREMENTS FOR AERIAL PHOTOGRAPHY, COVERAGE SPECIFICATIONS, AND THE AGENCY TO BE TASKED. SIMULTANEOUS ALERTING WOULD BE MADE OF THOSE AGENCIES POSSESSING PHOTOGRAPHIC INTERPRETATION AND PROCESSING RESOURCES FOR TASKING ON A QUICK-RESPONSE BASIS. INFORMATION ON THE COMPLETED PHOTOGRAPHIC MISSION WITH ASSOCIATED MISSION DATA IS TO BE MADE AVAILABLE WITHOUT DELAY TO USGS SPO, RESTON; THE OEP DISASTER OPERATIONS CENTER; AND OTHER USER AGENCIES.

UPON DELIVERY OF THE PROCESSED ORIGINAL FILM TO USGS SPO, RESTON, SCREENING AND SELECTION OF PHOTO FRAMES, PHOTO INTERPRETATION, LAYOUT OF MOSAICS (IF REQUIRED), PREPARATION OF ANNOTATIONS OR OTHER ILLUSTRATIVE MATERIALS WILL BE INITIATED. BRIEF AND EXPEDITED PHOTO INTERPRETATION REPORTS WITH ACCOMPANYING GRAPHICS WILL BE PREPARED FOR THE DIRECTOR, OEP; THE DISASTER OPERATIONS CENTER; THE FIELD; AND OTHER AGENCIES AS REQUIRED. RESPONSE TIME OF THE ORDER OF 8 TO 10 HOURS AFTER RECEIPT OF FILM IS PLANNED.

REQUESTS FOR ADDITIONAL INFORMATION FROM FEDERAL, STATE, AND LOCAL AGENCIES DURING THE EARLY PHASES OF DISASTER RESPONSE WOULD BE ACTED UPON ON A PRIORITY BASIS. WHEN THE NEED FOR IMMEDIATE RESPONSE AND READ-OUT HAS DIMINISHED DUE TO IMPROVEMENT OF THE LOCAL CONDITIONS OR FOR OTHER REASONS, PHOTOGRAPHIC SUPPORT THROUGH THIS MECHANISM WILL GRADUALLY SHIFT WHERE POSSIBLE TO MORE ROUTINE PROCEDURES OF INDIVIDUAL AGENCY ACTION AND SELF-SUPPORT. THE TASK GROUP ELEMENTS SO ALERTED AND ACTIVATED WILL DISASSEMBLE AND RETURN TO NORMAL DUTIES.

EXHIBIT III

BRIEFING "SPECTACULAR"

ON

"CAMILLE"

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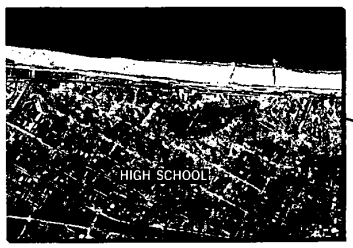
GULFPORT HARBOR AFTER "CAMILLE"
MISSISSIPPI



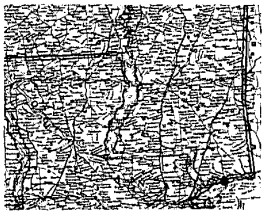


EXHIBIT IV

BRIEFING "SPECTACULAR"

ON

ANCHORAGE, ALASKA

AFTER 1964 EARTHQUAKE
ANCHORAGE, ALASKA

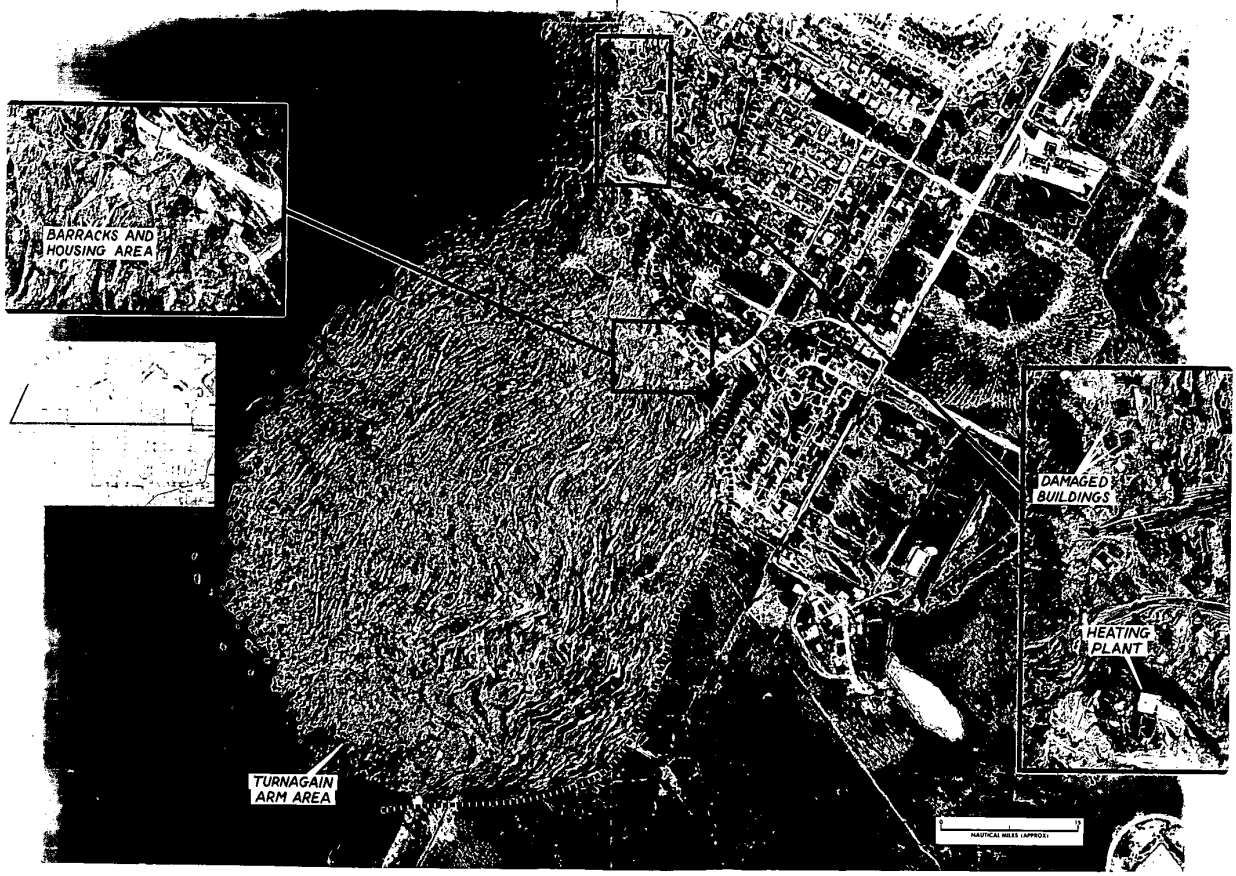


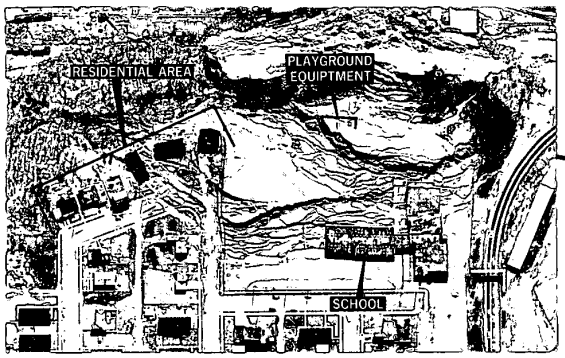
EXHIBIT V

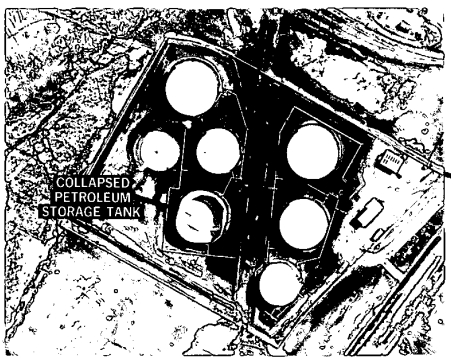
BRIEFING "SPECTACULAR"

ON

ANCHORAGE, ALASKA

EARTHQUAKE DAMAGE
ANCHORAGE ALASKA





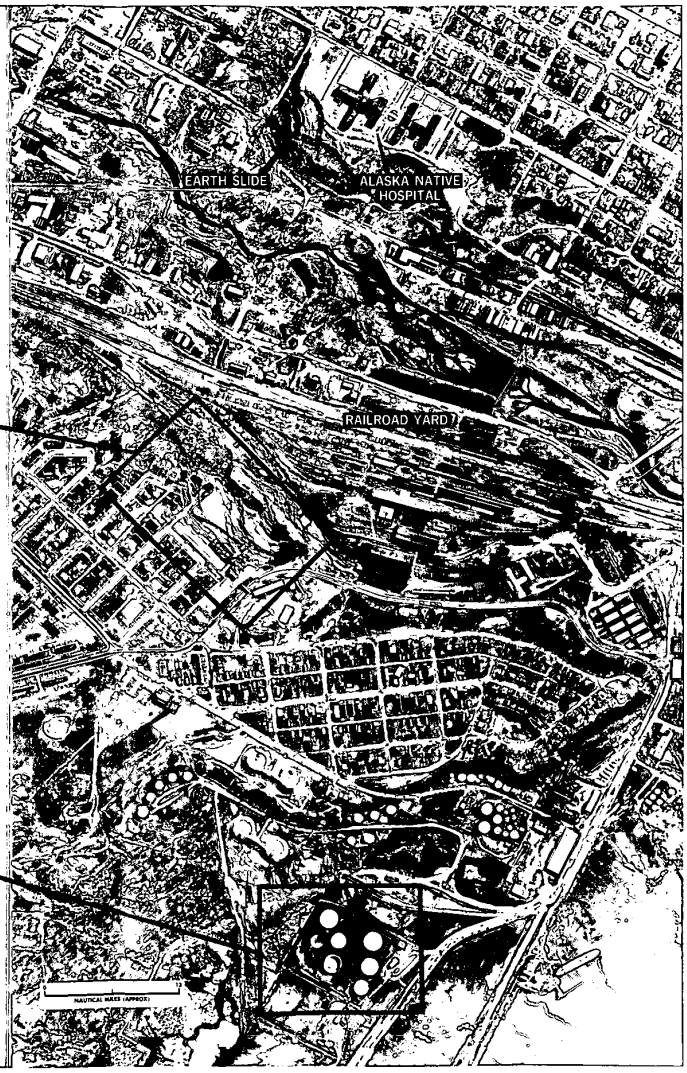


EXHIBIT VI

BRIEFING "SPECTACULAR"

ON

ANCHORAGE, ALASKA

AFTER 1964 EARTHQUAKE
ANCHORAGE, ALASKA

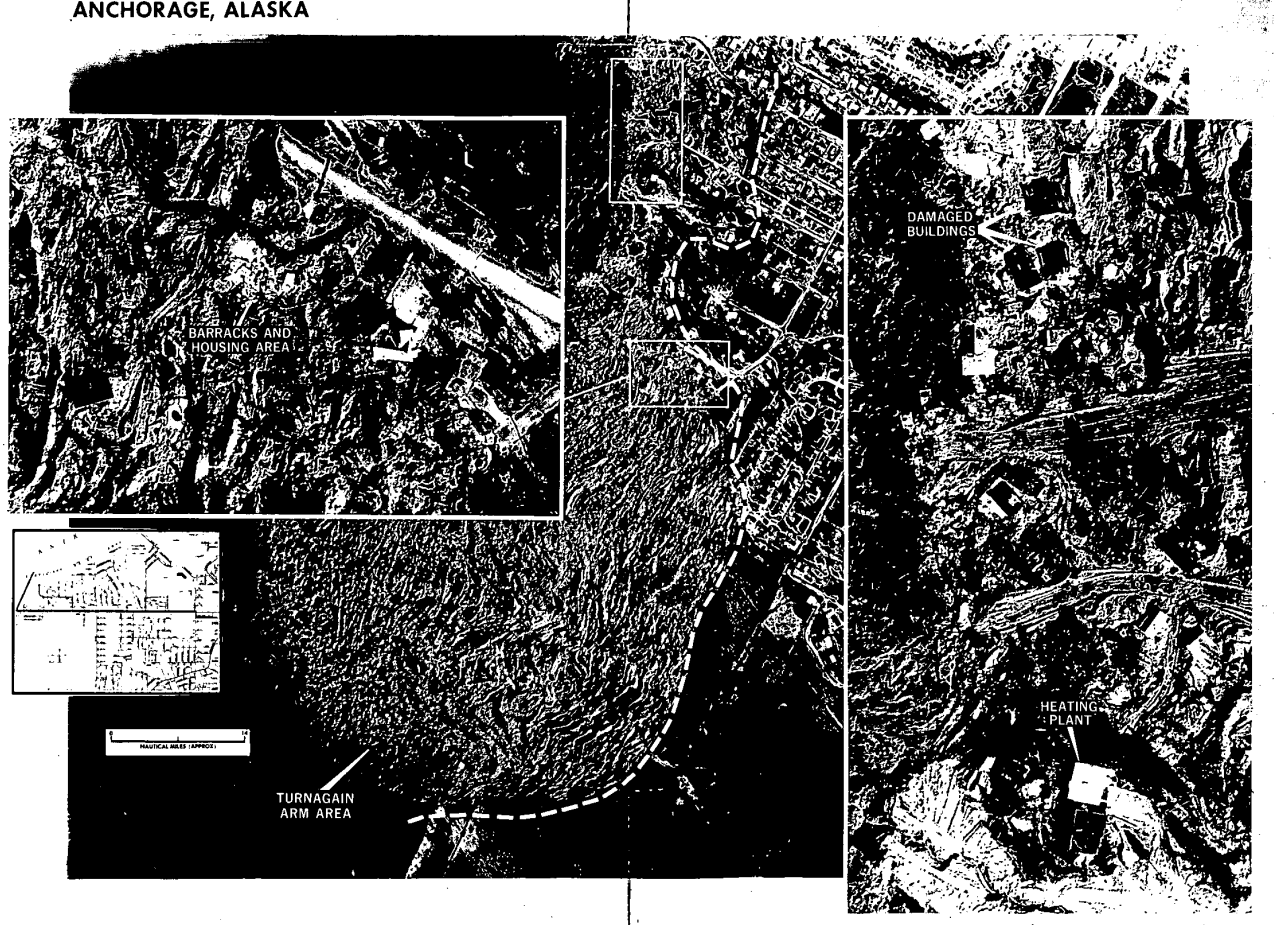


EXHIBIT VII

BRIEFING "SPECTACULAR"

ON

LUBBOCK, TEXAS

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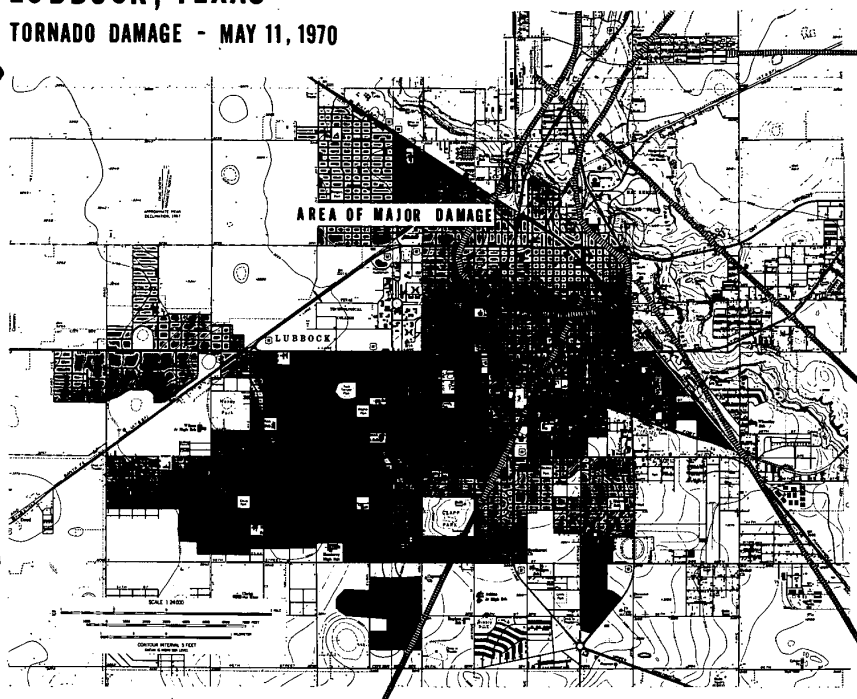
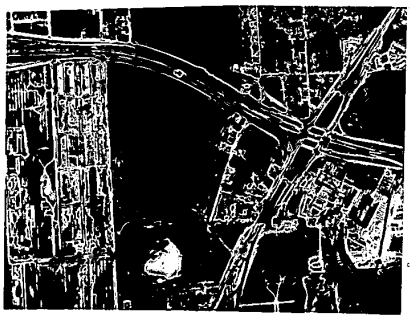
LUBBOCK, TEXAS

TORNADO DAMAGE - MAY 11, 1970



NE RESIDENTIAL AREA

GRAIN ELEVATORS



DOWNTOWN LUBBOCK

MACKENZIE PARK AREA

Prepared by:
OFFICE OF EMERGENCY PREPAREDNESS
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U.S. Army Topographic Command
U.S. Geological Survey

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